

# AMERICAN DENDROBATID GROUP

Newsletter No. 12

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The purpose of the ADG is to develop better communication between Dendrobatid breeders in North America. It is designed, by its format and bi-monthly distribution, to keep dendrobatid frog breeders in better communication with one another. We hope that with this communication we will be able to solve some of the problems which confront us all. This newsletter will appear bimonthly and will cost \$10.00 annually to cover printing and mailing.

Subscriptions, comments, etc. should be sent to Charles Powell (2932 Sunburst Dr., San Jose, CA 95111 Tel.: (408) 363-0926) or Terry Chatterton (P. O. Box 622, Kiowa, CO 80117 Tel.: (303) 621-2442).

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## State of art on Spindly-leg syndrome

In this issue the ADG bring together most of the current discussion on spindly-leg syndrome. In most cases it appears that the problem develops from a vitamin or mineral difficiency in the adult frogs. Antidotal accounts of curing spindly-leg by adding iodine to water containing tadpoles provides evidence for possible multiple causes for spindly-leg syndrome. I would like to encourage anyone who has had this problem with their frogs to write about their experiences for the Newsletter. This additional information will aid in our understanding of the problem.

### Spindly-leg Syndrome

by Steve Halfpenny

Reprinted with permission from British Dendrobatid Group Newsletter, No. 13, August 1992.

Dendrobatid breedings has been plagued by the spindly-leg syndrome in recent years, in the USA and Europe as well as in Britain. Breeders have been very disappointed to find, after spawning their frogs and carefully rearing the tadpoles, that they develop this condition, necessitating euthanasia immediately after metamorphosis.

The symptoms are small and ineffective forelimbs, though usually these are perfectly formed. Conversely, the hind limbs are normal. The causes of this condition have been debated and many varying reasons for its occurrence have been suggested. These have included a lack of some factors in the diet of either the parent frogs or the tadpoles, an incorrect environmental parameter, or a genetic problem. I have discounted the possibility of the syndrome being genetic in origin as it has occurred in clutches from frogs producing previously healthy larvae, occurring only after intensive breeding. I have also discounted the environmental factors, as I find it hard to believe an environmental parameter occurring in a breeder's vivarium but not in the wild state, to result in such a

handicapping condition.

As the forelimbs are the last to develop in the process of metamorphosis, this implies a lack or depletion of some factor that has been exhausted in the previous developmental stages. The larval diet consist generally of good-quality fish food. Whilst not a natural diet mimic, this food should provide all possible nutrients including minerals or all but one. The natural larval diet of non egg-feeders must consists of decaying plant and insect matter (detritus feeders), these items falling into the water body in which the larvae are living, be this a living bromeliad in the treetops, or mud puddle on the forest floor or the water in a discarded Coke can. It is possible that the female frog supplies the necessary developmental factors since the adult diet is far less restricted and thus vital vitamins and minerals may be passed on via the egg yoke.

I do not feel a lack of vitamins is responsible since I as well as others who have experienced this syndrome dust live food with multi-vitamin preparations. My search for a missing factor led me back to my biology text books. The developmental and metamorphosis of the tadpole into a frog involves complex morphological changes that are controlled by hormones. These hormones promote the development of certain cells to produce the new limbs and organs of the frog. The main hormone concerned with this cell differentiation is thyroxine, produced by the thyroid gland. Thyroxine contains iodine - if the diet of the parent or the tadpole were deficient in iodine, then there would be a deficiency of thyroxine, the hormone responsible for metamorphosis. There may be enough thyroxine for development up to a point, but not enough for the later developmental stage, that of forelimb growth.

I have started to use the iodine nibbles used for cage birds, added to the tadpoles; water and also dusted on the food for adult frogs. In a batch of *Dendrobates tinctorius* that had previously shown 100% offspring with spindly-leg, those tadpoles that had not started to develop limbs prior to iodine addition have developed into perfect frogs. I am still investigating iodine deficiency and would like to show recurrence of the syndrome when iodine is discontinued. However, the immediate correction after the addition of iodine suggests strongly that iodine deficiency is the cause of spindly-leg syndrome.

### More on Spindly leg disease

by Malcolm Peaker

Reprinted with permission from the British Dendrobatid Group Newsletter, No. 14, October 1992.

The question often asked is weather spindly-leg disease is seen in frogs other than dendrobatids. The answer is that it is, and clues as to its cause can be gained from studies in these other species.

The following is a very rough translation of the article by Karsten Krintler entitled, "Beobachtungen zum problem der 'Steicholzbeine' bei Dendrobatiden und Hyliden. Herpetofauna, 10(32): 30-31, 1988."

"Observations on *Hyla ebraccata*

"In April 1979 the author received six frogs bred in captivity. Five batches of eggs [were deposited] between 20 July and 16 November 1979 with 220, 200, 240, 430, and 285 eggs (number four possibly from two

females). The first two batches produced absolutely healthy young frogs. Batches 3, 4, and 5 all had spindly-leg disease. The anomalies were: no legs at all, one front leg spindly, both front legs spindly.

"Development of some young frogs stopped abruptly, for example, the tail stopped shrinking after front legs emerged; all died.

"The author agrees with Glaw that the anomalies were due to poor nutrition of the parents. The parents were fed on substantial quantities of sweepings before the first two batches of eggs which led to healthy frogs. Then there was poor weather for four weeks and no insects were available. They were then fed on house flies of which not enough were around; the flies were not treated with vitamins. Batches 3-5 were laid after this. Tadpoles of all batches were fed the same way.

"The author agreed with Glaw and with Zimmermann that the main cause of the anomaly is the nutrition and captive conditions of the parent."

I have been looking at my records with *D. truncatus*. There is certainly evidence that spindly-leg disease is due to a deficiency in the supply of some important nutrient in the female.

Last year I separated males from females and fed all the adults well for six months before putting them back together (they spawned within 1 to 2 days). The important thing was that at every feeding since they were separated they have been given fruit flies shaken with Cricket Plus® (Monkfield Nutrition, Monkfield, Bourn, Cambs CB3 7TD) which contains minerals and vitamins. I have not had a case of spindly-leg disease since, and my *D. truncatus* have bred just as intensively as last year. This suggests that spindly-leg disease is caused by a deficiency at an early developmental stage of one of the constituents of the additive (calcium, iron, copper, manganese, zinc, cobalt, iodine, vitamin A, vitamin D<sub>3</sub>, vitamin E, vitamin K, vitamin C, vitamin B<sub>1</sub>, vitamin B<sub>2</sub>, vitamin B<sub>6</sub>, vitamin B<sub>12</sub>). In the last BDG Newsletter, you will have seen that Steve Halfpenny's bet was placed on iodine deficiency. I must admit that my money is moving towards a mineral rather than one of the vitamins because there is anecdotal evidence that the addition of vitamins alone is not sufficient to alter the frequency of the disease.

Clearly, the importance of nutrition in keeping and rearing frogs makes it a worthwhile topic to consider in detail.

### More on spindly-leg...

by Bob Davies

Reprinted with permission from the British Dendrobatid Group Newsletter, No. 15, December 1992.

Reading Malcolm's comments on spindly-leg I am hopeful that we are moving slowly towards solving the problem. When we first experienced this disease some years ago, we assumed that it was due to incorrect tadpole husbandry. For feeding tadpoles we have always used a mixture of Aquarian Tropical fish Flake® and Tetra Conditioning Food® 80%-20% with the addition of a pinch of multi-vitamin powder (Cricket Plus®) and powdered cuttle fish bone all finely ground together. The reason for grinding was that the various coloured flakes each contain a different type of food. If they are not ground, a tadpole may satisfy its hunger on one particular flake and will not therefore get the necessary variety. Also, whole flakes tend to float and tadpoles may take in large amounts of air as they graze at the surface (I don't yet know if this has any adverse effect).

When we experienced spindly leg we tried adding extra vitamins to the tadpole food (both powdered and liquid) and extra cuttlefish bone but it did not prevent the disease. A tru-lite tube suspended over the tadpole containers had no effect either. At the time live foods were not dusted every time the frogs were fed, but we noticed that the incidence of spindly-leg was reduced when dusting was more frequent.

During the summer months our adult frogs are now given large amounts of greenfly [aphids] (obtained by 'sweeping' the sycamore trees in the garden). Small wax worms and dusted fruitflies are also supplied. Greenfly cannot be dusted with vitamins as they die very quickly, but they are a very nutritious food as we have proven over the years. For numerous years, we have successfully raised large numbers of *Hyla arborea* by feeding the young on greenfly and later on dusted houseflies and crickets. However, the supply of greenfly can be erratic - high winds, heavy rains or a cool spell can cause them to disappear and there is also the danger that they may be contaminated by insecticides.

A friend in Germany is working towards a solution. Rolf Schaad is a chemist and biologist who formulates his own vitamin/mineral mixture for dusting food items. In 1989, using two pairs of wild-caught *Epipedobates tricolor*, feeding was as follows: Pair A - food dusted with complete mixture of vitamins, minerals, amino acids and trace elements. All clutches hatched and grew without problems. Pair B - the food was not dusted. Results after three months: many of the eggs spoiled and spindly-leg appeared in young which did hatch. In 1990 the same experiment with different pairs of frogs produced the same results. Similar experiments are continuing to determine (if possible) the exact deficiency which is responsible. Rolf thinks the evidence points to a lack of manganese or zinc, possibly in combination with a vitamin.

It is obviously a slow process and may take some time to resolve. If such experiments could be carried out on a larger scale, I have no doubt the solution could soon be found.

## **Conformation of adult frogs causing spindly-leg in tadpoles**

by Charles L. Powell, II

I have a trio of *Dendrobates auratus* that were wild collected by Dr. Jack Frenkel in Panama several years ago. Since they started breeding for me, about three years ago, they have produced over 200 eggs of which only about 2% (4 or 5 frogs) have developed without spindly-leg. To correct this continuing problem I have tried varying food type, from Tetra Min®, to frozen high-protein foods produced by Ocean Nutrition® to Cichlid Soufflé (a high Spirulina algae food by Coralife®) and a few other thing in between. On an aside the best of these foods for development of large healthy tadpoles seems to be Tetra Min. Using the high-protein food produced tadpoles that developed faster than Tetra Min, but always at a significantly smaller size. While Cichlid Soufflé produced tadpoles that were slightly smaller than using Tetra Min. Through this all, the tadpoles have continued to developed spindly-leg syndrome. I have also changed the conditions the tadpoles were kept from individual jars with the water changed daily to a large community tank with the tadpoles separated in small individual plastic boxes and no water changes except to add water when it evaporated. These changes seems to make no discernable difference in tadpole develop-

ment and spindly-leg was always a problem.

With the help of Charles Nishihara I designed an experiment to determine if spindly-leg had its cause in some environmental factor in how I raised the tadpoles or if it was something intrinsic to the adult frogs and how they were kept. What we decided on was this: a group of tadpoles from my frogs and a group from some El Copé, Panama *D. auratus* from Charles were mixed in my community tadpole tank in which iodine was added from Cardinal Avian Iodine plus Calcium (no longer made) at an rate of 7 drops/week added every Friday. The tadpoles were separated in the individual boxes for about two weeks, (after which time cannibalism among the tadpoles seems to disappear in my tank except for individuals which are obviously deformed or not developing properly in some way). At that time the tadpoles were let loose in the tank. The tadpoles were feed at the same time and in amounts appropriate to their size.

After the required time all of Charles' El Copé *D. auratus* developed into normal froglets while all of my *D. auratus* developed spindly-leg or were cannibalized. Since the tadpoles were raised under identical conditions the development of spindly-leg had to be passed on to the tadpoles by the parents! B. Ian Hyler (personal communication, 1993) said he had a similar experience with *Phobabates bassleri* and reached the same conclusion. He has two pair of frogs which are kept under identical conditions and the tadpoles produced are raise in identical circumstances. One pair of *P. bassleri* constantly produced offspring with spindle leg while the other produced normal froglets.

It is quite possible that the problem can be linked to lack of iodine in the adults which is passed on to the offspring, but it could also be a lack of some other vitamin or mineral, alone or in combination. But it seems obvious that the problems is not something intrinsic to the tadpoles or how they are raised. That's not to say that the addition of iodine to the water in which your tadpoles are kept will not help in their development, but that the problem might be much more complicated that expected. In conclusion we need to keep our adult frogs in the best conditions possible in order to produce healthy offspring. This includes giving breeding frogs a break from time to time and providing an abundant and varied food supply.

### Helpful Hints

This new section is for "little bits" of information that are too small to be included as articles but which may be useful to others in any part of Dendrobatid culture.

The first tip comes from Kevin Izumi of Hawaii. Kevin discovered an article for trapping termites relatively cleanly which can then be fed to your frogs. The specifics of the trap can be found in an article by J. Kenneth Grace (1989, A modified trap technique for monitoring *Reticulitermes* subterranean termite populations (Isoptera: Rhinotermitidae). Pan-Pacific Entomologist, 65(4): 381-384). But in short it goes like this... "Using a trenching shovel, a hole is excavated of sufficient size to accommodate a 15-cm length of 10-cm (4-in.) ID plastic (ABS) pipe, placed vertically with the rim slightly below the soil surface. Two 15-cm lengths of 4-cm (1.5 in.) ID ABS pipe are then placed next to each other vertically within the larger pipe. Each of these smaller diameter pipes contains a tightly rolled sheet of moistened single-faced corrugated fiberboard (boxboard) as the termite feeding substrate.

\*\*\* The larger exterior pipe is then capped with an ABS test cap (Niagara Plastics Co.), and the cap covered with a thin layer of soil, leaves, or turf. The exterior pipe thus forms a permanent trap installation, while the interior pipes are easily removed and replaced with minimal disturbance to foraging galleries in the soil. When the interior pipes are removed, each end is capped with a small ABS plastic test cap, and termites are transported to the laboratory in the original collection pipe."

**Adds: For Sale**

<i>Dendrobates auratus</i> 'El Cope'	\$45	Charles Nishihara
<i>Dendrobates imitator</i>	\$65	3271 Pinao St.
<i>Dendrobates tinctorius</i> 'Cobolt'	\$35	Honolulu, HI 96822

The Serpent's Egg (1809 Irving St., NW, Washington, D.C. 20010 Tel. (202) 462 9443) has various wild caught and captive breed frogs for sale Write or call for information.

**New Members**

Alan Bryan (California)  
Daryl Lapham (California)  
Alicia Pinzari (Hawaii)  
Mark Pulawski (Ohio)  
Rex Lee Searcey (California)  
John Ball Zoological Gardens (Michigan)

**Dues are due**

Just a reminder that dues are now due and have been raised to \$10 for 1994. Please remember to send them in today.